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Point-Sampling Factors *for* *Southwestern Ponderosa Pine*

by
Clifford A. Myers

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION
RAYMOND PRICE, DIRECTOR FORT COLLINS, COLORADO
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POINT-SAMPLING FACTORS
FOR
SOUTHWESTERN PONDEROSA PINE

by

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Rocky Mountain Forest and Range Experiment Station ¹

¹ Central headquarters maintained in cooperation with Colorado State University at Fort Collins.

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Point-Sampling Factors For Southwestern Ponderosa Pine

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Volumes are computed from point-sample measurements of basal area by use of volume/basal area or point-sampling factors. Each factor is the number of cubic feet or board feet equivalent to 1 square foot of basal area. The factors presented here apply to ponderosa pine stands throughout Arizona and New Mexico. Volumes can be determined in merchantable cubic feet, board-feet International 1/4-inch rule, and board feet Scribner rule.

The techniques of point sampling have been described in numerous publications. A good discussion of the method was presented by Bonnett (1959). A simple procedure for determination of the number of sampling points (Allen and Mogren, 1960) and precautions on the use of point-sampling on small tracts (Afanasiev, 1958) have been published. Basic American references were prepared by Grosenbaugh (1952, 1955). Point-sampling techniques will not, therefore, be described here; this paper is limited to descriptions of the accompanying tables and instructions for their use.

DESCRIPTION OF TABLES

The first group of tables (1a to 5b) give point-sampling factors for each of numerous combinations of tree diameter and height. Volumes per square foot were obtained from the equations in the table footnotes. These equations resulted from the division of volume

equations of the form $V = a + bD^2 H$ (Myers, 1963) by $0.005454D^2$, a formula for basal area (B).

Tables 6a and 6b were derived from tables of the first group. The factor for each height class is the weighted average of the factors in that class given in the appropriate table of the first group. Weights were obtained from random samples of heights within diameter classes in all areas of commercial ponderosa pine in Arizona and New Mexico.

Unit of measure, stump height, and top diameter inside bark are given in the headings of tables 1a to 5b. Utilization of sawtimber was limited by variable top diameters inside bark, as follows:

<u>Tree dbh</u> (inches)	<u>Minimum top</u> <u>sawlog diameter</u> (inches)
12-13	8
14-21	9
22-26	10
27-31	11
32-35	12
36-39	13
40-42	14
43-45	15
46-47	16

These top diameters represent average full sawlog utilization of southwestern ponderosa pine.

Separate sets of factors are given for blackjack and old-growth ponderosa pines because their volume equations differ. Blackjack pines are immature or young mature trees with dark bark and relatively rapid taper. Old-growth pines have yellowish bark, often in broad flat plates, and less taper than blackjacks.

USE OF TABLES

Point-sample cruising for volume can be done in several ways. Diameters and heights of trees counted through the prism or relascope may be measured. Diameters may be estimated and heights measured. Heights of the counted trees may be measured and no record made of tree diameters. The procedure selected will depend on the accuracy desired and the time and personnel available for the job. Point-sampling factors are provided for each alternative.

Measurement of Diameter and Height

The diameter and height of each counted tree may be measured and a volume conversion factor selected for each combination of diameter and height (tables 1a to 5b). Volume per acre is computed as follows:

1. Multiply the number of counted trees in each diameter-height class by the point-sampling factor for the class.
2. Total the products of step one.
3. Multiply this total by the basal area factor of the prism or other angle gauge used.
4. Divide the product of step three by the number of points sampled on the tract.

Inspection of the tables shows that volume per square foot often does not differ greatly among trees of a single height class. For example, the volumes of blackjacks 80 feet tall vary from 27.3 to 29.9 cubic feet per square foot of basal area as diameter increases from 11 to 39 inches (table 1a). Board feet per square foot changes little with diame-

ter when tree heights are measured in logs (tables 4a to 5b). Therefore, the increase in time spent in the measurement of diameter may not result in any material increase in accuracy. Time can often be saved by the adoption of an alternative procedure. Heights of the counted trees can be measured while diameters are estimated and tallied by broad diameter classes. Or, heights can be measured and no record made of diameters.

Measurement Of Height Only

Measurement of heights only is recommended when volumes are to be determined in: (1) merchantable cubic feet or (2) in board feet if tree heights are measured in logs and stand structures are not highly irregular.

Point-sampling factors in tables 6a and 6b will be most useful where the distributions of diameters within height classes approximate those used in preparation of the tables. Differences in the relationship between height and diameter due to differences in site quality or stand density will change the factor for each height class. The changes will be small except for board feet with tree heights measured in feet.

If factors based on local conditions are desired, they may be obtained from tables 1a to 5b by almost the same procedure used to derive a local volume table from a standard table (Chapman and Meyer, 1949). The only difference is that diameters are plotted over heights instead of heights over diameters. This is because height will be retained as the measured variable.

Volumes are computed with the factors in tables 6a and 6b in the same way as when diameters are measured. The calculation will involve a maximum of 12 or 13 products of number of trees times factor for any one volume unit, instead of the many products computed when factors are selected for each combination of diameter and height.

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Table 1a.--Merchantable volume in cubic feet per square foot of basal area, blackjack ponderosa pine
Arizona and New Mexico

Cubic feet inside bark
Merchantable stem excluding stump and top

Top diameter 4.0 inches inside bark
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet												
	20	30	40	50	60	70	80	90	100	110	120	130	140
	----- Cubic feet -----												
5	5.2	8.5	11.7	15.0									
6	5.6	8.8	12.1	15.3	18.6								
7	5.8	9.1	12.3	15.6	18.8								
8	6.0	9.2	12.5	15.7	19.0	22.2							
9	6.1	9.3	12.6	15.8	19.1	22.3							
10	6.1	9.4	12.6	15.9	19.2	23.0							
11	6.2	9.5	12.7	16.0	19.8	23.5	27.3						
12	6.2	9.5	12.7	16.4	20.2	24.0	27.7	31.5					
13		9.5	13.0	16.8	20.5	24.3	28.1	31.9					
14		9.6	13.3	17.1	20.8	24.6	28.4	32.1	35.9				
15		9.7	13.5	17.3	21.0	24.8	28.6	32.4	36.1				
16			13.7	17.5	21.2	25.0	28.8	32.5	36.3				
17			13.8	17.6	21.4	25.2	28.9	32.7	36.5	40.2			
18			14.0	17.7	21.5	25.3	29.1	32.8	36.6	40.4			
19			14.1	17.9	21.6	25.4	29.2	32.9	36.7	40.5			
20			14.2	17.9	21.7	25.5	29.3	33.0	36.8	40.6			
21				18.0	21.8	25.6	29.3	33.1	36.9	40.6			
22				18.1	21.9	25.6	29.4	33.2	37.0	40.7			
23				18.2	21.9	25.7	29.5	33.2	37.0	40.8	44.6		
24				18.2	22.0	25.8	29.5	33.3	37.1	40.8	44.6		
25					22.0	25.8	29.6	33.3	37.1	40.9	44.7	48.4	
26					22.1	25.8	29.6	33.4	37.2	40.9	44.7	48.5	52.2
27					22.1	25.9	29.7	33.4	37.2	41.0	44.7	48.5	52.3
28					22.2	25.9	29.7	33.5	37.2	41.0	44.8	48.5	52.3
29					22.2	26.0	29.7	33.5	37.3	41.0	44.8	48.6	52.3
30					22.2	26.0	29.8	33.5	37.3	41.1	44.8	48.6	52.4
31					22.2	26.0	29.8	33.5	37.3	41.1	44.9	48.6	52.4
32					22.3	26.0	29.8	33.6	37.3	41.1	44.9	48.6	52.4
33					22.3	26.1	29.8	33.6	37.4	41.1	44.9	48.7	52.4
34						26.1	29.8	33.6	37.4	41.1	44.9	48.7	52.5
35						26.1	29.9	33.6	37.4	41.2	44.9	48.7	52.5
36						26.1	29.9	33.6	37.4	41.2	45.0	48.7	52.5
37						26.1	29.9	33.7	37.4	41.2	45.0	48.7	52.5
38						26.1	29.9	33.7	37.4	41.2	45.0	48.8	52.5
39							29.9	33.7	37.5	41.2	45.0	48.8	52.5
40								33.7	37.5	41.2	45.0	48.8	52.5
41								33.7	37.5	41.2	45.0	48.8	52.6
42								33.7	37.5	41.3	45.0	48.8	52.6
43								33.7	37.5	41.3	45.0	48.8	52.6

Derived from: $V/B = 0.32453 H - 37.6788/D^2$, above dotted line.

$V/B = 0.37697 H - 377.9752/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 1b.--Merchantable volume in cubic feet per square foot of basal area, old-growth ponderosa pine
Arizona and New Mexico

Cubic feet inside bark
Merchantable stem excluding stump and top

Top diameter 4.0 inches inside bark
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet										
	40	50	60	70	80	90	100	110	120	130	140
	Cubic feet										
12	14.8	19.0	23.1	27.3	31.4	35.5	39.7				
13	15.1	19.2	23.4	27.5	31.6	35.8	39.9				
14	15.3	19.4	23.6	27.7	31.8	36.0	40.1				
15	15.4	19.6	23.7	27.8	32.0	36.1	40.2				
16	15.6	19.7	23.8	28.0	32.1	36.2	40.4				
17	15.7	19.8	23.9	28.1	32.2	36.3	40.5	44.6			
18	15.8	19.9	24.0	28.2	32.3	36.4	40.6	44.7			
19	15.8	20.0	24.1	28.2	32.4	36.5	40.7	44.8	48.9		
20		20.0	24.2	28.3	32.4	36.6	40.7	44.9	49.0		
21		20.1	24.2	28.4	32.5	36.6	40.8	44.9	49.0	53.2	
22		20.2	24.3	28.4	32.6	36.7	40.8	45.0	49.1	53.2	
23		20.2	24.3	28.5	32.6	36.7	40.9	45.0	49.1	53.3	
24			24.4	28.5	32.6	36.8	40.9	45.0	49.2	53.3	
25			24.4	28.5	32.7	36.8	40.9	45.1	49.2	53.3	
26			24.4	28.6	32.7	36.8	41.0	45.1	49.2	53.4	
27			24.5	28.6	32.7	36.9	41.0	45.1	49.3	53.4	
28			24.5	28.6	32.8	36.9	41.0	45.2	49.3	53.4	57.6
29			24.5	28.6	32.8	36.9	41.0	45.2	49.3	53.4	57.6
30			24.5	28.7	32.8	36.9	41.1	45.2	49.3	53.5	57.6
31			24.5	28.7	32.8	36.9	41.1	45.2	49.3	53.5	57.6
32				28.7	32.8	37.0	41.1	45.2	49.4	53.5	57.6
33				28.7	32.8	37.0	41.1	45.2	49.4	53.5	57.6
34				28.7	32.9	37.0	41.1	45.3	49.4	53.5	57.7
35				28.7	32.9	37.0	41.1	45.3	49.4	53.5	57.7
36				28.7	32.9	37.0	41.1	45.3	49.4	53.6	57.7
37				28.8	32.9	37.0	41.2	45.3	49.4	53.6	57.7
38				28.8	32.9	37.0	41.2	45.3	49.4	53.6	57.7
39				28.8	32.9	37.0	41.2	45.3	49.4	53.6	57.7
40					32.9	37.1	41.2	45.3	49.5	53.6	57.7
41					32.9	37.1	41.2	45.3	49.5	53.6	57.7
42						37.1	41.2	45.3	49.5	53.6	57.7
43						37.1	41.2	45.3	49.5	53.6	57.7
44						37.1	41.2	45.3	49.5	53.6	57.8
45						37.1	41.2	45.4	49.5	53.6	57.8
46						37.1	41.2	45.4	49.5	53.6	57.8
47							41.2	45.4	49.5	53.6	57.8

Derived from: $V/B = 0.41346 H - 264.1790/D^2$

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 2a.--Volume in board feet Scribner rule per square foot of basal area, blackjack ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet												
	30	40	50	60	70	80	90	100	110	120	130	140	
	Board feet												
12	21	38	56	73	91	108	125						
13	26	43	60	78	95	112	130						
14	29	46	64	81	99	116	133	155					
15	32	49	67	84	101	119	142	167					
16		52	69	86	104	127	152	177					
17		54	71	88	110	135	161	186	211				
18		55	73	91	117	142	168	193	219				
19		57	74	98	123	148	174	199	225				
20			77	103	128	154	179	205	230				
21			82	107	133	158	184	209	235				
22			86	111	137	162	188	213	239				
23			89	115	140	166	191	217	242	267			
24			92	118	143	169	194	220	245	271			
25				120	146	171	197	222	248	273	299		
26				123	148	174	199	225	250	276	301	327	
27				125	150	176	201	227	252	278	303	329	
28				127	152	178	203	229	254	280	305	331	
29				129	154	180	205	230	256	281	307	332	
30				130	156	181	207	232	257	283	308	334	
31				132	157	183	208	233	259	284	310	335	
32				133	158	184	209	235	260	286	311	337	
33				134	160	185	210	236	261	287	312	338	
34					161	186	212	237	262	288	313	339	
35					162	187	212	238	263	289	314	340	
36					162	188	213	239	264	290	315	341	
37					163	189	214	240	265	291	316	342	
38					164	190	215	240	266	291	317	342	
39						190	216	241	267	292	318	343	
40							216	242	267	293	318	344	
41							217	242	268	293	319	344	
42							218	243	268	294	319	345	
43							218	244	269	294	320	345	

Derived from: $V/B = 1.7384 H - 4855.5739/D^2$, above dotted line.

$V/B = 2.5462 H - 21011.4393/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 2b.--Volume in board feet Scribner rule per square foot of basal area, old-growth ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet										
	40	50	60	70	80	90	100	110	120	130	140
----- Board feet -----											
12	36	58	80	102	124	146	168				
13	43	65	87	109	131	153	175				
14	49	71	93	115	137	159	181				
15	54	76	98	120	142	164	188				
16	58	80	102	124	146	171	200				
17	61	83	105	127	152	181	210	238			
18	64	86	108	132	160	189	218	246			
19	66	88	110	139	167	196	225	253	282		
20		90	116	144	173	202	231	259	288	317	
21		92	121	150	178	207	236	265	293	322	
22		97	125	154	183	212	240	269	298	326	
23		101	129	158	187	215	244	273	302	330	
24			133	161	190	219	248	276	305	334	
25			136	165	193	222	251	279	308	337	
26			138	167	196	225	253	282	311	340	
27			141	170	198	227	256	285	313	342	
28			143	172	201	229	258	287	315	344	373
29			145	174	202	231	260	289	317	346	375
30			147	176	204	233	262	290	319	348	377
31			148	177	206	235	263	292	321	349	378
32				179	207	236	265	293	322	351	380
33				180	209	237	266	295	324	352	381
34				181	210	239	267	296	325	353	382
35				182	211	240	268	297	326	355	383
36				183	212	241	269	298	327	356	384
37				184	213	242	270	299	328	357	385
38				185	214	242	271	300	329	357	386
39				186	215	243	272	301	329	358	387
40					215	244	273	301	330	359	388
41					216	245	273	302	331	360	388
42						245	274	303	332	360	389
43						246	275	303	332	361	390
44						247	275	304	333	361	390
45						247	276	304	333	362	391
46						248	276	305	334	362	391
47							277	305	334	363	392

Derived from: $V/B = 2.1933 H - 8090.5757/D^2$, above dotted line.
 $V/B = 2.8724 H - 23775.6656/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 3a.--Volume in board feet International $\frac{1}{4}$ -inch rule per square foot of basal area, blackjack
ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet												
	30	40	50	60	70	80	90	100	110	120	130	140	
	----- Board feet -----												
12	21	42	64	85	107	128	150						
13	27	48	70	91	113	135	156						
14	32	53	75	97	118	140	161	185					
15	36	58	79	101	122	144	168	194					
16		61	82	104	125	150	176	202					
17		64	85	107	130	157	183	209	235				
18		66	88	110	136	162	188	215	241				
19		68	90	115	141	167	193	219	245				
20			92	119	145	171	197	223	249				
21			96	122	148	174	201	227	253				
22			99	125	151	177	204	230	256				
23			102	128	154	180	206	232	259	285			
24			104	130	156	182	209	235	261	287			
25				132	158	185	211	237	263	289	315		
26				134	160	186	213	239	265	291	317	343	
27				136	162	188	214	240	266	293	319	345	
28				137	163	189	216	242	268	294	320	346	
29				138	165	191	217	243	269	295	322	348	
30				140	166	192	218	244	270	297	323	349	
31				141	167	193	219	245	272	298	324	350	
32				142	168	194	220	246	273	299	325	351	
33				143	169	195	221	247	273	300	326	352	
34					170	196	222	248	274	300	327	353	
35					170	197	223	249	275	301	327	353	
36					171	197	223	250	276	302	328	354	
37					172	198	224	250	276	302	329	355	
38					172	198	225	251	277	303	329	355	
39						199	225	251	277	304	330	356	
40							226	252	278	304	330	356	
41							226	252	278	305	331	357	
42							227	253	279	305	331	357	
43							227	253	279	305	332	358	

Derived from: $V/B = 2.1533 H - 6870.6637/D^2$, above dotted line.

$V/B = 2.6164 H - 16133.6238/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 3b.--Volume in board feet International $\frac{1}{4}$ -inch rule per square foot of basal area, old-growth ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Total height in feet										
	40	50	60	70	80	90	100	110	120	130	140
	Board feet										
12	46	72	98	123	149	175	200				
13	54	80	106	131	157	183	208				
14	61	86	112	138	163	189	215				
15	66	92	117	143	169	194	222				
16	70	96	122	147	173	201	230				
17	74	100	125	151	178	208	237	267			
18	77	103	128	155	184	214	243	273			
19	80	105	131	160	189	219	248	278	307		
20		107	135	164	194	223	253	282	311	341	
21		109	139	168	198	227	256	286	315	345	
22		113	142	171	201	230	260	289	319	348	
23		116	145	174	204	233	263	292	321	351	
24			147	177	206	236	265	295	324	353	
25			150	179	209	238	267	297	326	356	
26			152	181	210	240	269	299	328	358	
27			153	183	212	242	271	300	330	359	
28			155	184	214	243	273	302	331	361	390
29			156	186	215	245	274	304	333	362	392
30			158	187	217	246	275	305	334	364	393
31			159	188	218	247	277	306	335	365	394
32				189	219	248	278	307	336	366	395
33				190	220	249	279	308	337	367	396
34				191	221	250	279	309	338	368	397
35				192	221	251	280	310	339	369	398
36				193	222	252	281	310	340	369	399
37				193	223	252	282	311	341	370	399
38				194	224	253	282	312	341	371	400
39				195	224	254	283	312	342	371	401
40					225	254	283	313	342	372	401
41					225	255	284	313	343	372	402
42						255	284	314	343	373	402
43						255	285	314	344	373	403
44						256	285	315	344	374	403
45						256	286	315	345	374	403
46						257	286	315	345	374	404
47							286	316	345	375	404

Derived from: $V/B = 2.5669 H - 8800.8801/D^2$, above dotted line.

$V/B = 2.9411 H - 17420.8616/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 4a.--Volume in board feet Scribner rule per square foot of basal area, blackjack ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Number of merchantable 16-foot logs												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
	----- Board feet -----												
12	51	71	92	113	133								
13	49	70	91	111	132	152							
14	48	69	90	110	131	151							
15	47	68	89	109	130	153	180						
16	47	67	88	109	130	157	185	213					
17	46	67	87	108	134	161	189	216					
18		66	87	110	137	165	192	220	247				
19		66	86	112	140	167	195	222	250				
20		65	87	115	142	170	197	225	252				
21		65	89	117	144	172	199	227	254				
22		65	91	119	146	174	201	229	256				
23		65	93	120	148	175	203	230	258	285			
24		67	94	122	149	177	204	232	259	287			
25			95	123	150	178	205	233	260	288	315		
26				124	151	179	206	234	262	289	317	344	
27				125	152	180	207	235	262	290	317	345	
28				126	153	181	208	236	263	291	318	346	
29				127	154	182	209	237	264	292	319	347	374
30				127	155	182	210	237	265	292	320	347	375
31				128	155	183	210	238	265	293	320	348	376
32				129	156	184	211	239	266	294	321	349	376
33				129	157	184	212	239	267	294	322	349	377
34				130	157	185	212	240	267	295	322	350	377
35				130	157	185	213	240	268	295	323	350	378
36					158	185	213	240	268	295	323	350	378
37					158	186	213	241	268	296	323	351	378
38					159	186	214	241	269	296	324	351	379
39						186	214	241	269	296	324	352	379
40							214	242	269	297	324	352	379
41							215	242	270	297	325	352	380
42							215	242	270	297	325	352	380
43							215	243	270	298	325	353	380

Derived from: $V/B = 41.2162 H + 1497.1764/D^2$, above dotted line.

$V/B = 55.0204 H - 9550.8089/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 4b.--Volume in board feet Scribner rule per square foot of basal area, old-growth ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Number of merchantable 16-foot logs												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
	----- Board feet -----												
12	45	70	95	120	146	171							
13	45	71	96	121	147	172	197						
14	46	71	97	122	147	173	198						
15	47	72	97	123	148	173	198	224					
16	47	72	98	123	148	174	199	227					
17	48	73	98	123	149	174	202	232					
18		73	98	124	149	176	206	236	266				
19		73	99	124	149	179	209	239	269	299			
20		74	99	124	152	182	212	242	272	302	332		
21		74	95	125	155	185	214	244	274	304	334	364	
22			97	127	157	187	217	247	276	306	336	366	
23				129	159	189	218	248	278	308	338	368	
24				130	160	190	220	250	280	310	340	370	
25				132	162	192	222	252	282	311	341	371	
26				133	163	193	223	253	283	313	343	373	
27				134	164	194	224	254	284	314	344	374	
28				135	165	195	225	255	285	315	345	375	
29				136	166	196	226	256	286	316	346	376	
30				137	167	197	227	257	287	317	347	377	407
31				138	168	198	228	258	288	318	347	377	407
32				139	169	199	228	258	288	318	348	378	408
33					169	199	229	259	289	319	349	379	409
34					170	200	230	260	290	319	349	379	409
35					170	200	230	260	290	320	350	380	410
36					171	201	231	261	291	321	350	380	410
37					171	201	231	261	291	321	351	381	411
38						202	232	262	291	321	351	381	411
39						202	232	262	292	322	352	382	412
40						202	232	262	292	322	352	382	412
41						203	233	263	293	322	352	382	412
42							233	263	293	323	353	383	413
43							233	263	293	323	353	383	413
44							234	263	293	323	353	383	413
45							234	264	294	324	354	383	413
46							234	264	294	324	354	384	414
47								264	294	324	354	384	414

Derived from: $V/B = 50.5655 H - 933.4892/D^2$, above dotted line.

$V/B = 59.8509 H - 11544.2484/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 5a.--Volume in board feet International $\frac{1}{4}$ -inch rule per square foot of basal area, blackjack
ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Number of merchantable 16-foot logs												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
	Board feet												
12	62	86	110	134	158								
13	60	84	108	132	156	180							
14	58	82	106	130	154	177							
15	57	81	105	129	151	180	208						
16	56	80	104	128	154	182	210	238					
17	55	79	103	127	155	184	212	240					
18		78	102	129	157	185	213	242	270				
19		78	102	130	158	186	215	243	271				
20		77	103	131	159	187	216	244	272				
21		77	104	132	160	188	217	245	273				
22		76	104	133	161	189	218	246	274				
23		77	105	133	162	190	218	247	275	303			
24		78	106	134	162	191	219	247	275	304			
25			106	135	163	191	219	248	276	304	333		
26				135	163	192	220	248	276	305	333	361	
27				136	164	192	220	249	277	305	333	362	
28				136	164	193	221	249	277	306	334	362	
29				136	165	193	221	249	278	306	334	363	391
30				137	165	193	221	250	278	306	335	363	391
31				137	165	194	222	250	278	307	335	363	391
32				137	165	194	222	250	279	307	335	363	392
33				137	166	194	222	251	279	307	335	364	392
34				138	166	194	223	251	279	307	336	364	392
35				138	166	194	223	251	279	308	336	364	392
36					166	195	223	251	279	308	336	364	393
37					167	195	223	251	280	308	336	364	393
38					167	195	223	252	280	308	336	365	393
39						195	223	252	280	308	336	365	393
40							224	252	280	308	337	365	393
41							224	252	280	308	337	365	393
42							224	252	280	309	337	365	393
43							224	252	280	309	337	365	394

Derived from: $V/B = 47.7723 H + 2257.4716/D^2$, above dotted line.

$V/B = 56.5466 H - 4377.0735/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 5b.--Volume in board feet International $\frac{1}{4}$ -inch rule per square foot of basal area, old growth
ponderosa pine
Arizona and New Mexico

Board feet inside bark
Merchantable stem excluding stump and top

Top diameter variable
Stump height 1.0 foot

Diameter breast height outside bark (Inches)	Number of merchantable 16-foot logs												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
	Board feet												
12	56	86	115	145	174	203							
13	57	86	116	145	174	204	233						
14	57	86	116	145	175	204	233						
15	57	87	116	145	175	204	234	263					
16	57	87	116	146	175	204	234	263					
17	58	87	116	146	175	205	234	263					
18		87	117	146	175	205	234	260	290				
19		87	117	146	175	205	231	261	292	323			
20		87	117	146	176	201	232	263	293	324	355		
21		87	117	146	176	203	233	264	295	325	356	387	
22			117	146	173	204	234	265	296	326	357	388	
23				146	174	205	235	266	297	327	358	388	
24				144	175	205	236	267	297	328	359	389	
25				145	175	206	237	267	298	329	359	390	
26				145	176	207	237	268	299	329	360	391	
27				146	177	207	238	269	299	330	361	391	
28				146	177	208	238	269	300	330	361	392	
29				147	178	208	239	270	300	331	361	392	
30				147	178	209	239	270	301	331	362	393	423
31				148	178	209	240	270	301	332	362	393	424
32				148	179	209	240	271	301	332	363	393	424
33					179	210	240	271	302	332	363	394	424
34					179	210	241	271	302	333	363	394	424
35					180	210	241	271	302	333	363	394	425
36					180	210	241	272	302	333	364	394	425
37					180	211	241	272	303	333	364	395	425
38						211	241	272	303	333	364	395	425
39						211	242	272	303	334	364	395	426
40						211	242	272	303	334	364	395	426
41						211	242	273	303	334	365	395	426
42							242	273	303	334	365	395	426
43							242	273	304	334	365	396	426
44							242	273	304	334	365	396	426
45							243	273	304	334	365	396	426
46							243	273	304	335	365	396	427
47								273	304	335	365	396	427

Derived from: $V/B = 58.8214 H - 389.9661/D^2$, above dotted line.

$V/B = 61.3012 H - 5523.7105/D^2$, below dotted line.

Diameter classes full-inch; e.g. 20-inch class includes 20.0 to 20.9.

Table 6a.--Tree volumes per square foot of basal area by tree heights, blackjack and old-growth ponderosa pines (measured in feet)

Tree height (feet)	Blackjacks			Old-growth		
	Merchantable cubic feet	Board feet Scribner	Board feet International	Merchantable cubic feet	Board feet Scribner	Board feet International
20	5.3	--	--	--	--	--
30	9.0	21	26	11.0	--	--
40	12.6	41	50	15.3	44	55
50	16.5	63	74	19.5	70	84
60	20.9	86	102	23.8	101	120
70	25.1	117	135	28.2	138	160
80	29.3	156	171	32.4	178	199
90	33.2	194	208	36.7	218	234
100	37.2	230	242	40.9	255	272
110	41.1	258	271	45.2	290	305
120	45.0	286	300	49.4	324	338
130	48.7	311	325	53.6	354	368
140	52.4	336	350	57.7	384	398

Table 6b.--Tree volumes per square foot of basal area by tree heights, blackjack and old-growth ponderosa pines (measured in logs)

Tree height logs	Blackjacks		Old-growth	
	Board feet Scribner	Board feet International	Board feet Scribner	Board feet International
1.0	50	60	45	57
1.5	69	83	71	86
2.0	89	106	97	116
2.5	112	130	123	146
3.0	142	158	154	176
3.5	176	190	186	206
4.0	206	220	224	237
4.5	236	249	255	269
5.0	265	278	286	301
5.5	293	307	318	332
6.0	321	336	349	364
6.5	350	365	380	395
7.0	378	393	411	426



Myers, Clifford A.

1963. Point-sampling factors for southwestern ponderosa pine.
U. S. Forest Serv. Res. Paper RM-3, 15 pp., illus.
Rocky Mountain Forest and Range Experiment Station,
Fort Collins, Colorado.

Presents factors for cubic feet to a 4.0-inch top, board feet
Scribner rule to a variable top, and board feet International
1/4-inch rule to a variable top. Tree heights are in feet
and numbers of logs, with and without subdivision by diameter
classes.

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Scribner rule to a variable top, and board feet International
1/4-inch rule to a variable top. Tree heights are in feet
and numbers of logs, with and without subdivision by diameter
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and numbers of logs, with and without subdivision by diameter
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1/4-inch rule to a variable top. Tree heights are in feet
and numbers of logs, with and without subdivision by diameter
classes.

